Understanding the Causal Links between Financial Development and International Trade

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Abstract

This paper analyses the causal relationship between financial development and international trade using data of 21 developed and developing countries from 1961 to 2010 and appropriate time series techniques that allow us to decompose the source of causation according to the order of integration of the variables and the possible presence of a cointegrating relationship. We analyze in detail the issue of integration of our series in order to use the most appropriate stationarisation techniques on non-stationary series. We also account for the major problems encountered in empirical studies on issues of causality link between finance and the real economy. Our results provide little support to the view that financial development is a leading factor in the participation of countries in international trade. Mainly, we find a bi-directional relationship between the levels of finance and trade. Moreover, it appears that the causality pattern varies across countries with different levels of economic development. Overall, the development of the financial sector contributes more to the causal relationship in the developing countries than in the developed countries. These results are robust to the use of an alternative method of testing for causality and to the use of alternative indicators or financial development and international trade.

Mots clés /Key words : Financial Development, Manufacturing Trade, Granger Causality test, Error Correction Model

Codes JEL / JEL codes : O16, F36, C32

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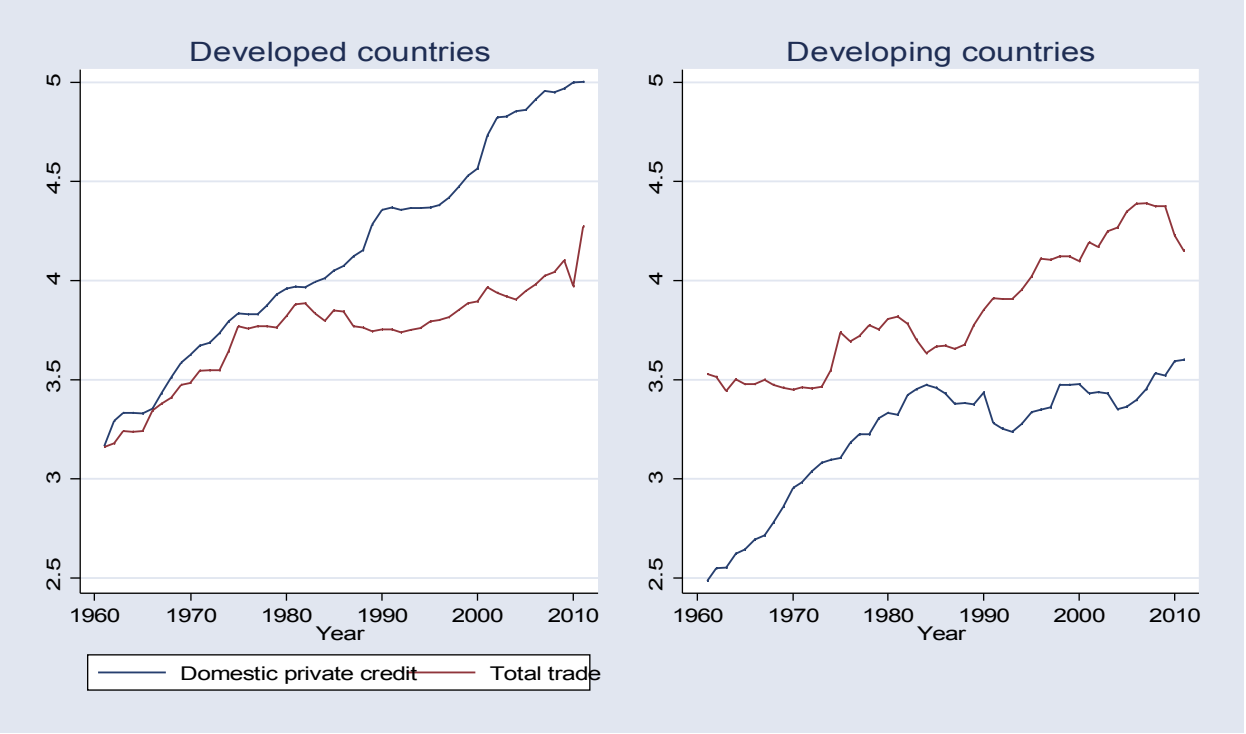
1. Introduction

A look at some basic international trade and financial development statistics gives us a sense of the importance of the relationship between trade and finance. Figure 1 shows the ratios of total trade and domestic private credit to GDP over the period 1966-2010 for developed and developing countries. The most obvious feature of this figure is the long-term upward trend both in trade and finance, in developed and developing countries. Financial development is higher in developed countries whilst trade openness is growing faster in developing countries. It is also clear that there is a positive association between

FIGURE 1 – Average trade and financial development over the period 1966-2012



financial development and international trade over the 1966-2010 period. This positive correlation between finance and trade is generally interpreted as if finance is a leading sector in international trade and economic development. However, this is also consistent with a second alternative explanation of the relationship between finance and trade. This is the case when financial development follows international trade, as a result of increased demand for financial services. What about the direction of causality between finance and trade ? Perhaps the pattern of trade is an outcome of financial sector development or vice versa.

The issue of the relationship between financial development and trade flows has only

recently been addressed in the empirical literature (See, for instance Beck, 2002; Svaleryd & Vlachos, 2005; Becker & Greenberg, 2007; Manova, 2008; Amiti & Weinstrein, 2011). The theoretical underpinnings of such a relationship can be traced back to the seminal work of Kletzer & Bardhan (1987) and Baldwin & Krugman (1989). Using cross-section and panel data for both developed and developing countries these studies find evidence that countries' level of international trade is exogenously affected by the health of their financial sector. However, an opposite viewpoint on the relationship between finance and trade is well documented. In this literature, the financial sector development is found to be an outcome of the supply and demand for external finance. The demand of a well-developed financial sector may be higher in countries with industrial structure that rely heavily on external finance. Accordingly, the pattern of trade may affect the countries' demand for financial institutions. Countries with comparative advantage in financially intensive sectors will experience a higher need for financial services, and therefore higher levels of financial intermediary development. This hypothesis has been recently formalized theoretically by (Do & Levchenko, 2007) and has found a number of empirical evidence (See for instance Huang & Temple, 2005; Klein & Olivei, 2008; Baltagi *et al.*, 2009). Their results show that countries that export financially dependent goods experience better-developed financial systems than countries whose exports are primarily in sectors which use less external finance.

Yet, this controversial recognition of the positive association between financial sector development and international trade is insufficient in establishing the direction of causality between finance and trade openness. How to reconcile these two viewpoints ? Following Patrick (1966) who analyzed the possible directions of causality between finance and the real economy by suggesting supply-leading and demand-following hypotheses, we argue that there might be multiple directions of causality in the relationship between finance and trade. Thus, the supply-leading hypothesis reflects the situation where the development of financial intermediaries' activities increases the supply of financial services. This implies additional gains in comparative advantage in industries that rely heavily on external finance, suggesting greater participation in international trade. In this case, the direction of causality runs from financial development to international trade. At the same time, the demand-following hypothesis suggests that increased demand for financial services might cause an increase in financial intermediation as the nonfinancial real sector grows. This implies that the development of the financial sector development follows than leads the

development of the real sector.[1] The demand of a well-developed financial sector may be higher in countries with industrial structure that rely heavily on external finance, and therefore that the industrial structure could also determine the development of the financial system. The first and only empirical attempt addressing this issue of causality between finance and trade was by Gries *et al.* (2009). They use data from 16 countries to test for causality between financial deepening, trade openness, and economic development. Their main finding is that finance and trade have swayed economic development rather marginally in sub-Saharan African countries. Their sample, however, was very restrictive, consisting only of developing countries. This implies that their findings are difficult to interpret and generalize.

This paper, to the best of our knowledge, is the first study which tackles the issue of causality between financial development and international trade using a large database from both developed and developing countries and decomposing the source of causation. We account for two main problems encountered in empirical studies on issues of causality link between the financial development and economic growth. First, we use alternative measures of financial development that reflect the level and quality of the financial system. Given that our sample contains both developed and developing countries, market-based financial systems dimension is not taken into account in the choice of the indicators of financial development.[2] Second, we analyze in detail the issue of integration of our series in order to use the most appropriate stationarization techniques on non-stationary series.

Our results provide little support to the view that financial development is leading factor in the participation of countries in international trade. We mainly find a bi-directional relationship between the level of financial development and international trade. Moreover, it appears that the causality patterns vary across countries. Overall, the development of the financial sector contributes more to the causal relationship in developing countries than in developed countries. The rest of the paper is organized as follows. Section 2 provides the theoretical and empirical arguments for supply-leading and demand-following phenomena in the relationship between finance and trade. Section 3 describes the empirical methodology and the data and Section 4 presents our main results. In Section 5 we discuss the robustness of these results. Section 6 concludes.

1. This was originally established by Robinson (1952), who argued that "where enterprise leads finance follows".

2. See for instance, Allen & D. (2000) for a discussion of these issues.

2. Finance and international trade : the supply-leading and demand-following hypotheses

2.1. The supply-leading hypothesis

Financial sector development is an important determinant of international trade patterns. Sectors differ in their need of financial services mainly due to technological and organizational differences. The theoretical arguments of such a relationship are first developed by Kletzer & Bardhan (1987), Baldwin & Krugman (1989) and Ju & Wei (2005). They show that financial factors exogenously influence international trade flows . In this way, financial sector can be viewed as a source of comparative advantage in a way consistent with the Hecksher-Ohlin-Vanek (HOV) model. The HOV model predicts that a country better endowed with institutions of relatively high quality should tend to specialize in the production of goods relatively intense in the use of services provided by these institutions. This idea has been extended and applied to the quality of financial systems. The quality of institutions in general, and financial sector development in particular, can be considered as an endowment (See for instance Acemoglu *et al.*, 2001). More precisely, countries endowed with relatively well-developed financial sectors will experience a comparative advantage in sectors that use more external finance. On the contrary, countries with less developed financial system will specialize in goods not requiring external finance.

At the firm-level, the quality of financial system can be defined by how well it manage to overcome the informational and enforcement frictions as well as how successfully firms with positive net present value projects can satisfy their need for external finance. Developed financial systems might improve the exporting firms' ability to satisfy their demand for external finance and, therefore, their capacity to easily cope with sunk costs of entry into foreign markets. Furthermore, more borrowing and lending made possible by a more developed financial sector may be associated with lower volatility in exporting firms' total output.[3] In this case, trade openness is endogenous and is determined by the level of financial intermediation.

Empirical support for this hypothesis has been found in a number of studies including Beck (2002), Beck (2003), Svaleryd & Vlachos (2005), and Manova (2005). The seminar

3. However, excessive lending (credit boom) may often found as a source of increased volatility and bank crises Thomas (2009).

work in this empirical literature is by Beck (2002). He use private credit ratio to GDP as a indicator of financial development and a range of measures of trade openness based on manufacturing trade. Using a 30-year panel data for 65 countries and after controlling for unobserved heterogeneity and reverse causality, he shows that countries with a higher level of financial development experience higher shares of manufactured exports in GDP and in total merchandise exports and have a higher trade balance in manufactured goods. Beck (2003) uses Rajan & Zingales (1998)'s data on external dependence for 36 industries and 56 countries and shows that countries with better-developed financial systems have higher export shares and trade balances in industries that use more external finance. More recently, Svaleryd & Vlachos (2005) study the OECD countries and found a strong causal impact of financial sector development on the specialization pattern of international trade and comparative advantage. Similarly, Manova (2005) find evidence for an additional comparative advantage channel based on the level of financial development. Potential exporters face credit constraints and their capacity to enter an industry depends on the sector's dependence on external finance.

2.2. The demand-following hypothesis

The evolution of financial sector can be seen as an outcome of the supply and demand for external finance. International trade might, therefore, lead to financial systems development, mainly due to an increasing demand for financial services by foreign-oriented sector. On the one hand, countries with comparative advantage in financially intensive sectors are more likely to experience a higher demand for financial services. On the other hand, financial sector development is lower in countries with comparative advantage in sectors which do not rely on external finance. The demand for external finance by foreign-oriented firms may lead to the creation of modern financial institutions and financial sector development. Indeed, at microeconomic level, the hypothesis is that financial constraints affects firms' participation to international markets (Chaney, 2005; Manova, 2006; Greenaway *et al.*, 2007; Muuls, 2008; Bellone *et al.*, 2010). This could be explained the firms' heterogeneity and the relevance of sunk costs at the entrance of the international markets. These sunk costs include finding foreign partners and buyers, learning about foreign markets, meeting foreign standards and regulations, establishing distribution networks, and bearing exchange risks and transportation costs. These sunk costs can be considered as investments that are likely sensitive to financial factors. In the presence of credit

constraints, the productivity threshold required for entry into exporting is relatively low in financially developed countries.

At macroeconomic level, comparative advantage in trade may affect a country's demand for financial institutions (Do & Levchenko, 2007). Countries with comparative advantage in financially intensive sectors will experience a higher need for financial services, and therefore financial sector development. Accordingly, the demand for external finance depends upon the growth of foreign-oriented sector and the growth of real sector. Owing to sunk costs and financial constraints in the entering foreign markets, the faster the growth of exporting firms output, the greater will be the demand for financial services and financial intermediation.

A number of empirical studies found evidence for this hypothesis. Huang & Temple (2005) study the relationship between trade and finance from cross-country and time series data. Their findings indicate that increases in goods market openness are followed by sustained increases in financial sector development. Klein & Olivei (2008) examine the relationship between capital account liberalization, financial development and economic growth using cross-country data over the periods 1986-1995. They show that capital account liberalization exerts a positive and significant effect on economic growth via the financial sector development in developed countries. Using data from developing and developed countries, Baltagi *et al.* (2009) show that both trade and financial openness significantly affect the level of banking sector development. Furthermore, their findings indicate that relatively closed countries stand to benefit most from opening up their trade and/or capital accounts.

This paper aims at extending and reconciling these two opposite view on the relationship between financial development and international trade. More specifically, we seek to understand the direction of causality between finance and trade. The idea is that the causality patterns could vary across countries and that bi-directional relationship between the level of finance and trade may exist. One of the reasons of this hypothesis is the role of supply-leading and demand-following phenomena in the finance-trade nexus.

3. Empirical method and data

3.1. Testing for the direction of causality

The issue of causality is how useful an economic time series are for forecasting another. This forecasting relationship between two variables have been proposed by Granger (1963) and developed by Sims (1972). A variable X_t is said to Granger-cause another series Y_t if, given the past of Y_t, past values of X_t can help forecast Y_t. More formally, X_t Granger-causes Y_t if for all $\tau > 0$ the mean squared error (MSE) of a forecast of $Y_{t+\tau}$ based on $(Y_t, Y_{t-1}, ...)$ is different from the MSE of a forecast of $Y_{t+\tau}$ that use both $(Y_t, Y_{t-1}, ...)$ and $(X_t, X_{t-1}, ...)$. In the linear functions case :

$$MSE[E(Y_{t+\tau}|\Theta_t)] \neq MSE[E(Y_{t+\tau}|\Theta_t^{'})] \tag{1}$$

where Θ_t represents the total available information and $\Theta_t^{'}$ is the information available excluding the past and present of X_t. Thus, X_t Granger-causes Y_t if X_t is found to be linearly informative about future Y_t. If the event X Granger-causes the event Y, then X should precede Y. However, the causality may be the result of some intrinsic property of the system rather than a prediction. In this case, this definition of causality could be a misleading wording.

Sims (1972) adopts this definition to allow for this shortcoming. Let's consider the following linear projection of X_t on past, present and future of Y_t :

$$X_t = \alpha + \sum_{\infty}^{k=0} \beta_k Y_{t-k} + \sum_{\infty}^{k=1} \chi_k Y_{t+k} + \epsilon_t \tag{2}$$

where β_k and χ_k represent the population projection coefficients and ϵ_t the error term such as $E(Y_{t+k}, \epsilon_t) = 0$, for all t and k. Thus, Y Granger-causes X whenever $\chi_k \neq 0$ for $k = 1, 2, ...$

Several other versions of Granger causality tests have been proposed (for a selective survey, See for instance Pierce & Haugh, 1977; Geweke *et al.*, 1983) but the common feature of all these tests is that they can be sensitive to the choice of lag length and/or the methods used to address the potential problem of nonstationarity of the series.

Empirically, a well known method to test for Granger causality is to test the null hypothesis that the estimated coefficients on the lagged values of X_t are jointly zero after regressing Y_t on its own lagged values and on lagged values of X_t. If the data reject this

hypothesis, then X_t Granger-causes Y_t. Therefore, future values of Y_t are better forecast if the information in past values of X_t is used than if it is not. This is usually done in a standard bivariate kth order VAR which can be presented as follows :

$$X_t = \alpha_1 + \beta_{11}(L)X_{t-1} + \beta_{12}(L)Y_{t-1} + \epsilon_{1t} \tag{3}$$

$$Y_t = \alpha_2 + \beta_{21}(L)X_{t-1} + \beta_{22}(L)Y_{t-1} + \epsilon_{2t} \tag{4}$$

Where α_1 and α_2 are constant drifts and β_{ij} represent polynomials of order $k-1$ in the lag operator L. For example, the null hypothesis that X does not Granger-cause Y implies zero polynomial β_{21}. This can be tested by an standard F-test. For equation in the VAR, the question in whether the other endogenous variable does not Granger-cause the dependent variable in that equation. Implementing this testing procedure is quite straightforward when both X_t and Y_t are stationary, with finite variance. Otherwise, testing for causality becomes more complex and need to be re-parametrized in the equivalent error correction model (ECM) form (Engle, 1987; Johansen, 1988). The idea is that X_t and Y_t achieves stationarity after differencing, but a linear combination of these two variables $\alpha' * Z$ is already stationary, with $Z = (X, Y)$. Therefore, X_t and Y_t are said to be cointegrated with cointegrating vector α. If there are several co-integrating vectors, then a becomes a matrix. $\alpha' * Z = 0$ can be interpreted as the long run equilibrium and the cointegration suggests that deviations from this equilibrium are stationary, with finite variance, even if X_t and Y_t have unit roots. In this case, the bivariate VAR (equations 3 and 4) have to be rewrite as follows :

$$\Delta X_t = \alpha_1 + \lambda_{11}\Delta X_{t-1} + \lambda_{12}\Delta Y_{t-1} + [\beta_{11}(1) - 1]X_{t-1} + \beta_{12}(1)Y_{t-1} + \epsilon_{1t} \tag{5}$$

$$\Delta Y_t = \alpha_2 + \lambda_{21}\Delta X_{t-1} + \lambda_{22}\Delta Y_{t-1} + \beta_{21}(1)X_{t-1} + [\beta_{22}(1) - 1]Y_{t-1} + \epsilon_{2t} \tag{6}$$

Where λ_{ij} stand for polynomials of order $k-2$.

This is the most interesting case because the causal relationship between X_t and Y_t may have two sources of causation. First, through the lagged dynamic terms (ΔX_{t-1}), if $\lambda_{21} \neq 0$ and, second, through the lagged cointegrating vector (X_{t-1}), if $\beta_{21}(1) \neq 0$. However, if X_t and Y_t have the same number of unit roots and that the linear combination of these two variables $\alpha' * Z$ is not stationary, then the Granger causality tests may be implemented in a first differenced VAR framework. In addition, the ECM-based causality test cannot be carried out when X_t and Y_t do not have the same number of unit roots. In this case,

there is no co-integration and the causality must be tested on stationary series of X_t and Y_t, as in the first differenced VAR framework.

We used the widely applied Dickey-Fuller procedure to carry out the unit root tests, namely the Augmented Dickey-Fuller (ADF) tests. ADF tests use a parametric autoregression to approximate the ARMA structure of the errors in the test regression. [4] The Engle (1987)'s technique is used to carried out the cointegration tests. [5]

3.2. The data

Our sample was constructed based on a number of criteria. The country must have at least 30 continuous annual observations on our variables of interest and its total population must exceed 3 millions in 2000. Twenty-one countries have met this criteria, namely Algeria, Argentina, Australia, Canada, Denmark, Egypt, El Salvador, Guatemala, Honduras, India, Israel, Japan, Korea. Rep., Malaysia, Mexico, New Zealand, Paraguay, Philippines, Thailand, United States, and Venezuela. Our measures of financial development and international trade flows come from World Development Indicators 2010. All the variables used in Granger-causality tests are transformed into logarithms for the usual statistical reasons. In the following, we first describe our measures of financial development and then the indicators of international trade. Table 1 summarizes descriptive statistics and contemporaneous correlations between these variables in logarithm.

In this study, we would like measure of how countries' financial sector improves the firms' ability to fulfill their need for external finance. Therefore, our primary measure of financial development is *Private Credit*, which equals the ratio of domestic credit allocated to private sector to GDP (excluding credit to central, development, and private banks). [6] The intuition underlying this indicator is that there is large differences across countries in the level of development and the quality of domestic financial sector and these differences are associated with both the level and the structure of international trade. Recent work show that manufacturing trade is strongly and robustly associated with the level of financial sector development, measured by the ratio of credit to private sector to GDP (See for

4. The basic unit root tests proposed by Dickey & Fuller (1981) involve fitting the regression model $\Delta Y_t = \rho Y_{t-1}$+(constant, time trend)+$\mu_t$ by ordinary least squares (OLS). However, these unit root tests are only valid when the time series Y_t is well characterized by an AR(1) with white noise error term. Said & Dickey (1984) augment this basic procedure allowing the use of general ARMA(p,q) models with unknown orders. These tests are therefore called ADF tests.

5. Using Johansen (1988)'s procedure does not alter our findings on the cointegration between financial development and international trade. These results are available upon request.

6. GDP stands for gross domestic product.

TABLE 1 – Descriptive Statistics : 1961-2010

	Private Credit	*M2*	*Manufacturing Trade*	*Total Trade*
Descriptive statistics				
Mean	3.587	3.707	4.660	3.810
Median	3.381	3.703	4.617	3.991
Maximum	4.973	4.962	5.023	4.806
Minimum	2.795	2.871	4.294	2.812
Std. Dev.	0.608	0.514	0.201	0.533
Observations	21	21	21	21
Correlations				
Private Credit	1	-	-	-
M2	0.848	1	-	-
	(0.000)	1	-	-
Manufacturing Trade	0.630	0.398	1	-
	(0.002)	(0.073)	-	-
Total Trade	-0.033	0.031	-0.180	1
	(0.886)	(0.891)	(0.433)	-

Note : $p - values$ are reported in parentheses.

instance Beck, 2002, 2003; Do & Levchenko, 2007). In our sample, countries with better-developed financial sectors (the top 25 percent of the distribution of the *Private Credit*) held about two-thirds of the *Private Credit* over the 1961-2010 period, while countries with less developed financial sector (the bottom 25 percent) held only less than a quarter of he *Private Credit* over this period. The second measure of financial development, *M2*, is a broad measure of the money stock. In the empirical literature on the relationship between finance and growth, *M2* has been the widely used as an indicator of financial development (See for instance King & Levine, 1993; Calderòn & Liu, 2003; Do & Levchenko, 2007). There are, however, two limitations with this indicator. First, the broad money fails to capture the key function of the financial system, namely the mobilization of savings and the channeling of these funds to the private sector projects. Second, the use of *M2* is not consistent with Shaw's 'intermediation' effect due to the fact that in developing countries the broad money stock is essentially held outside the banking system. *M2* is greater than 4.960 percent in countries with better-developed financial sectors and less that 2.870 percent in countries with less developed financial sector.

Our first proxy for international trade, *Manufacturing Trade*, is the ratio of manufacturing trade to total merchandise trade. Manufacturing trade equals the sum of exports and imports of manufactured goods. The assumption underlying the use of this measure is that manufactured goods are considered as goods with increasing returns to scale in line with the standard analytical framework of international trade theory (See for instance chapter 6 in Krugman & Obstfeld, 2009). Indeed, sectors of goods with increasing returns to scale enjoy from a higher level of external finance more than sectors of other goods,

by allowing them to exploit scale economies (Beck, 2002). Thus, manufacturing sector is more dependent on external finance than other sectors due to increasing returns to scale. As for the measure of financial development there is wide variation across countries in *Manufacturing Trade*. The most open countries (the top 25 percent of the distribution of the *Manufacturing Trade*) experience more than two-thirds of the *Manufacturing Trade* over the 1960-2010 period, while countries with less developed financial sector (the bottom 25 percent) held only 13 percent the *Manufacturing Trade* over this period. Furthermore, we will use, *Total Trade*, defined as the ratio of total trade to GDP, as an additional trade indicator. *Total Trade* equals the sum of exports and imports of goods and services.

4. Empirical Results

4.1. Evidence from unit roots and cointegration tests

Does financial development cause international trade ? Do bi-directional and/or reverse causation between trade and finance exist ? To understand the nature of the relationship between finance and trade, we first use Dickey-Fuller procedure (ADF tests) to test for unit in order to establish the degree of integration of each time series. Given that ADF tests may be sensitive to the order of augmentation, the lag length is determined automatically based on Akaike information criterion (AIC), the maximum lag length being 10. In unreported unit root tests, results using Phillips & Perron (1988) nonparametric unit root tests confirm our results those of ADF tests. The Phillips-Perron(PP) unit root tests differ from the ADF tests mainly in how they deal with the Autoregressive Moving-Average (ARMA) structure of the errors in the test. The PP tests ignore any serial correlation in the regression. [7]

The results of ADF unit root tests are presented in Tables 5 and 6 in Appendix. The results of the tests in levels of all variables are reported in Table 5 and those of the tests for unit root in first differences are in Table 6. The null hypothesis in these unit root tests is that the underlying variable contains a unit root against the alternative that the variable was generated by a stationary process. Overall, the results from ADF tests suggest that the measures of both financial development and international trade are I(1) in most of

7. However, although the PP procedure has the advantage of being robust to specification errors, it is more size distorted than the ADF tests when ΔY_t has an ARMA representation with a large and negative MA component (Schwert, 1989).

countries. Their values in levels are nonstationary whilst their values in first differences are stationary. The hypothesis that the logarithm of *Private Credit* and *M2* contains a unit root cannot be rejected for the countries with exceptions of Honduras, Japan, Mexico, and Venezuela. *M2* is only stationary in Japan, Mexico, and Venezuela while *Private Credit* is stationary in Honduras, Mexico, and Venezuela. Also, the hypothesis of a unit root in the the logarithm of *Total Trade* cannot be rejected for the countries with exceptions of Canada, Egypt, El Salvador, Guatemala, Honduras, and Korea. Rep.. However, for *Manufacturing Trade* this hypothesis is rejected only for 2 of the 21 countries of our sample (Israel and Venezuela).

As indicated in Subsection 3.1, the next step is to test for the existence of a possible stable relationship between the measures of financial development and those of international trade. For this purpose we test for the existence of a cointegrating relationship between finance and trade using the well known Engle-Granger technique (Engle, 1987). All stationary series are not considered in theses tests. Table 7 in Appendix presents the results of cointegration tests, with ADF test statistics. [8] As in the unit root tests, the lag length is determined automatically based on AIC. These results suggest that one of our measures of financial development is cointegrated with at least one measure of international trade in 14 countries (Australia, Canada, Denmark, Egypt, Guatemala, India, Israel, Japan, Korea. Rep., Malaysia, New Zealand, Paraguay, Philippines, Thailand). [9] Seven of the 21 countries show no evidence of cointegration between any measures of financial development and international trade (Algeria, Argentina, El Salvador, Israel, Philippines, Thailand, and United States). Countries which show no evidence of cointegration between any measures of international trade and financial development are Algeria, Argentina, Australia, El Salvador, Honduras, Malaysia, and United States. However, these results do not necessarily imply the existence of a stable economic relationship between financial development and international trade. This may be explain by a possible non-linear relationship or the choice of our measures of financial development and international trade. Given these results, causality tests are carried out using two types of procedures, namely ECM-based causality tests and Causality tests based on first difference VARs.

8. ADF test statistic are those of the ADF tests for unit root in the cointegrating regression residuals.

9. Using Johansen (1988)'s procedure does not alter our findings on the cointegration between financial development and international trade. These results are available upon request.

4.2. ECM-based causality tests

ECM-based causality tests are carried out using the Engle-Granger cointegrating vectors for countries for which there is at least one pair of measures of financial development and international trade showing evidence of cointegration. The results of these tests are presented in Table 2 and 3. Table 2 presents the results of causality tests between the measures of financial development and *Manufacturing Trade* whilst Table 3 presents those between the measures of financial development and *Total Trade*. F-test and t-test statistics are reported to test whether the causality comes from the lagged dynamic terms, the error correction term or both, under the null hypotheses of non-causation.

The results presented in Table 2 reject Granger non-causality between financial development and international trade, when *Manufacturing Trade* is employed. The hypothesis of non-causality from *Private Credit* to *Manufacturing Trade* is rejected at the 5% level in one of the three countries examined (India) whilst the hypothesis of non-causality from *Manufacturing Trade* to *Private Credit* is rejected in the two other countries (Denmark and Paraguay). These causation come from the error correction term, with exception of Paraguay where we find evidence for the two sources of causation. On the other hand, where *M2* is used as the financial development indicator, these results reject the hypothesis of non-causality from *M2* to *Manufacturing Trade* at least at the 5% level, with exception of Israel. Furthermore, Granger non-causality from finance to trade is rejected with exceptions of only 2 of the 6 countries considered when using *M2* (Egypt and Guatemala). This can be explained by the fact that the broad money stock is not as relevant as the *Private Credit* to measure the level of financial development. Once again, the causation comes mainly from the error correction term. The hypothesis of non-causality from *Manufacturing Trade* to *M2* is rejected in 3 of the 6 countries examined (India, Philippines, and Thailand). Denmark is found to experience a bi-directional causality between *M2* and *Manufacturing Trade*.

In Table 3, we present results using *Total Trade* as the indicator of international trade. The hypothesis of non-causality from *Private Credit* to *Total Trade* is rejected in 5 of the 8 countries examined (Australia, Egypt, Guatemala, Korea. Rep., and Malaysia) whilst the hypothesis of non-causality from *Total Trade* to *Private Credit* is rejected in 50% of the countries (Australia, Canada, Guatemala, and Korea. Rep.). As before, the error correction term is found to be the main source of the causation. We find evidence for

TABLE 2 – ECM tests with Engle and Granger cointegrating vectors : *Private Credit*, *M2* and *Manufacturing Trade*

Country	H0							H0						
	PC $\overset{NO}{\rightarrow}$ MT		MT $\overset{NO}{\rightarrow}$ PC					M2 $\overset{NO}{\rightarrow}$ MT		MT $\overset{NO}{\rightarrow}$ M2				
	D.PC	PC(-1)	D.MT	MT(-1)				D.M2	M2(-1)	D.MT	MT(-1)			
	F-tests	*t*-tests	*F*-tests	*t*-tests	k	AIC	n	*F*-tests	*t*-tests	*F*-tests	*t*-tests	k	AIC	n
Denmark	1.15	-0.62	0.11	2.24**	1	4.36	40	1.51	2.78**	1.53	1.94*	5	-7.00	37
India	1.70	2.21**	0.82	1.33	4	3.00	44	3.42**	2.33**	1.11	0.20	5	-4.77	43
Israel	-	-	-	-	-	-	-	1.15	0.91	2.21*	1.11	5	-4.23	42
Paraguay	0.46	-1.63	4.72***	5.60***	5	2.87	40	0.57	0.23	2.68**	2.68**	5	-4.33	40
Philippines	-	-	-	-	-	-	-	0.33	2.92***	1.03	0.40	2	-4.06	46
Thailand	-	-	-	-	-	-	-	0.74	2.05**	0.15	0.44	2	-4.87	46

Note : PC, M2, MT, and TT denote *Private Credit*, *M2*, *Manufacturing Trade*, and *Total Trade*, respectively. X(-1) denotes the lagged value of the variable X.

TABLE 3 – ECM tests with Engle and Granger cointegrating vectors : *Private Credit*, *M2*, and *Total Trade*

Country	H0							H0						
	PC $\overset{NO}{\rightarrow}$ TT		TT $\overset{NO}{\rightarrow}$ PC					M2 $\overset{NO}{\rightarrow}$ TT		TT $\overset{NO}{\rightarrow}$ M2				
	D.PC	PC (-1)	D.TT	TT(-1)				D.M2	M2 (-1)	D.TT	TT(-1)			
	F-tests	t-tests	F-tests	t-tests	k	AIC	n	F-tests	t-tests	F-tests	t-tests	k	AIC	n
Australia	1.94	3.30***	1.75	2.01*	5	-5.86	38	-	-	-	-	-	-	-
Canada	1.78	1.06	3.30**	4.88***	5	-4.15	33	0.87	1.79*	3.50**	5.17***	5	-4.75	33
Denmark	-	-	-	-	-	-	-	2.83*	0.37	3.06*	4.34***	2	-6.56	40
Egypt	4.79**	0.37	0.71	0.93	2	-1.86	42	0.33	0.33	0.97	1.33	5	-3.26	39
Guatemala	2.68**	0.46	0.79	2.09**	5	-3.16	40	0.65	0.92	1.03	1.63	3	-3.59	42
India	-	-	-	-	-	-	-	0.77	3.19***	2.73**	0.09	4	-5.88	44
Japan	1.23	-1.38	2.75**	1.35	5	-4.99	34	-	-	-	-	-	-	-
Korea. Rep	1.00	2.24**	0.99	-1.75*	4	-3.94	43	3.51**	2.41**	0.90	1.50	2	-4.51	45
Malaysia	0.30	2.57**	0.62	0.84	3	-4.05	42	-	-	-	-	-	-	-
New Zealand	1.49	0.87	5.04***	0.39	4	-3.57	34	2.38*	0.76	3.07**	0.30	4	-4.87	34
Paraguay	-	-	-	-	-	-	40	1.46	1.11	2.40*	4.09***	5	-2.88	40
Philippines	-	-	-	-	-	-	-	1.42	0.90	2.18*	1.91*	4	-4.43	44
Thailand	-	-	-	-	-	-	-	3.27**	3.78***	2.07	0.35	4	-5.77	44

Note : PC, M2, MT, and TT denote *Private Credit*, *M2*, *Manufacturing Trade*, and *Total Trade*, respectively. X(-1) denotes the lagged value of the variable X.

double causality in 3 countries (Australia, Guatemala, and Korea. Rep.). The hypothesis that *M2* does Granger-cause *Total Trade* is rejected in 6 of 10 countries considered whilst the reverse non-causality is also rejected in 6 countries. In this case, the causation seems to come from the lagged dynamic terms.

On the whole, these results show that the relationship between financial development and international trade might be more robust when using *Private Credit* and *Manufacturing Trade* as the measure of financial development and international trade, respectively. This is consistent with the idea mentioned in Subsection 3.2. Sectors of goods with increasing returns to scale (manufactured goods) enjoy from a higher level of external finance more than sectors of other goods, due to gains from economies of scale. Furthermore, results from ECM-based causality tests indicate that financial development is strongly linked to international trade, with a direction of causality varying across countries. The Granger causality from financial development to international and the Granger causality from international trade to financial development coexist.

4.3. Causality tests based on first difference VARs

With regard to countries for which there is no evidence for cointegration between financial development and international trade, we conduct causality tests based on first-difference VARs. This is the case of countries with stationary series and those which show no evidence for cointegration for pairs of variables. In Table 4 and 5 we present the results using first-differenced VARs and report the F-tests for the joint significance of the dynamic terms. Table 4 presents the results of causality tests between the measures of financial development and *Manufacturing Trade* whilst Table 5 presents those between the measures of financial development and *Total Trade*.

In Table 4, where the financial indicator used is the *Private Credit*, the results show that there is evidence for causality in all of the 18 countries examined. For 6 of these 18 countries the direction of causality run from *Manufacturing Trade* to *Private Credit* while there is evidence for the reverse causality in Japan. For 11 of the 18 countries, we find evidence for bi-directional causality. A very similar picture is painted when using *M2* as the indicator of financial development. In this case, there is evidence of causality between financial development and international trade in the countries considered, with exception of Malaysia. In Canada, El Salvador, and Japan, there is evidence of causality running from *M2* to *Manufacturing Trade* and evidence for the reverse causality in Algeria, Australia,

TABLE 4 – Causality tests based on first difference VARs : D.*Private Credit*, D.*M2*, and D.*Manufacturing Trade*

Country	H0		k	AIC	n	H0		k	AIC	n
	D.PC $\overset{NO}{\rightarrow}$ D.MT	D.MT $\overset{NO}{\rightarrow}$ D.PC				D.M2 $\overset{NO}{\rightarrow}$ D.MT	D.MT $\overset{NO}{\rightarrow}$ D.M2			
Algeria	1.68	9.48***	5	-2.42	31	0.48	2.36*	6	-3.97	30
Argentina	2.35*	3.11**	9	-3.14	39	3.23**	2.10*	7	-3.92	41
Australia	2.17	4.52**	12	-5.35	31	0.73	3.05**	7	-6.46	36
Canada	4.48**	2.56*	12	-5.04	34	2.18*	1.19	9	-5.40	37
Egypt	0.96	7.06**	1	-2.55	44	2.52**	3.25**	7	-4.03	38
El Salvador	2.13*	1.99*	9	-0.81	38	2.86*	1.47	2	-3.19	45
Guatemala	4.04***	2.44*	6	-3.87	39	2.16*	2.24*	7	-3.86	38
Honduras	3.23**	2.22*	7	-3.74	37	5.59***	4.24**	3	-4.87	41
Israel	0.95	2.04*	8	-5.42	40	-	-	-	-	-
Japan	7.73***	1.80	12	-8.43	35	7.27***	0.40	12	-8.56	35
Korea. Rep.	2.71**	3.00**	6	-7.03	41	2.46*	10.55***	2	-6.45	45
Malaysia	0.70	5.63***	5	-4.34	40	0.19	1.70	3	-4.12	42
Mexico	2.38*	3.70**	12	-2.37	36	4.41**	7.43***	2	-4.58	46
New Zealand	0.44	4.15***	4	-4.79	36	0.37	2.51*	4	-6.07	36
Philippines	2.18*	2.02*	6	-2.27	42	-	-	-	-	-
Thailand	2.46**	2.25*	10	-3.12	38	-	-	-	-	-
United States	2.59**	3.76***	9	-7.49	38	2.92**	2.18*	8	-8.41	39
Venezuela	2.33*	3.82**	11	-2.76	35	2.78**	2.76**	11	-3.51	35

Note : PC, M2, MT, and TT denote *Private Credit*, *M2*, *Manufacturing Trade*, and *Total Trade*, respectively.

and New Zealand. Once again, we find strong evidence for bi-directional causality between financial development and international trade.

TABLE 5 – Causality tests based on first difference VARs : D.*Private Credit*, D.*M2*, and D.*Total Trade*

Country	H0		k	AIC	n	H0		k	AIC	n
	D.PC $\overset{NO}{\rightarrow}$ D.TT	D.TT $\overset{NO}{\rightarrow}$ D.PC				D.M2 $\overset{NO}{\rightarrow}$ D.TT	D.TT $\overset{NO}{\rightarrow}$ D.M2			
Algeria	1.06	3.88**	6	-0.27	31	1.31	2.46*	9	-1.95	28
Argentina	0.86	2.75**	9	0.03	40	2.03*	0.82	10	-0.30	39
Australia	-	-	-	-	-	3.93*	3.19*	12	-6.85	31
Denmark	2.34*	0.82	9	-2.05	39	-	-	-	-	-
El Salvador	2.72**	3.01**	4	-2.68	44	7.18***	0.33	3	0.33	45
Honduras	2.08*	0.50	7	-3.53	38	3.74*	2.04	1	2.04	44
India	0.12	2.93*	2	-4.64	47	-	-	-	-	-
Israel	4.79**	0.44	1	-3.57	48	0.88	2.99**	11	-1.32	38
Japan	-	-	-	-	-	0.67	0.13	2	-4.84	46
Malaysia	-	-	-	-	-	2.50*	2.14*	5	-3.84	41
Mexico	1.01	7.10***	3	-2.77	46	2.03*	1.21	8	-2.94	41
Paraguay	0.61	2.17*	4	-1.84	45	-	-	-	-	-
Philippines	0.86	2.48**	9	-2.84	40	-	-	-	-	-
Thailand	2.48*	2.93**	3	-4.62	46	-	-	-	-	-
United States	4.29***	2.71**	5	-6.10	43	3.17*	1.13	1	-7.29	47
Venezuela	0.65	2.98*	2	-1.96	45	2.52**	3.18**	9	-2.32	38

Note : PC, M2, MT, and TT denote *Private Credit*, *M2*, *Manufacturing Trade*, and *Total Trade*, respectively.

In Table 3, we present results of the causality tests between the measures of financial development and *Total Trade*. When the *Private Credit* is used, we find evidence for causality between financial development and international trade in all of the 13 countries considered. Denmark, Honduras, Israel exhibit one-way causality running from *Private Credit* to *Total Trade*. In 7 of the 13 countries, there is evidence of causality running

from *Total Trade* to *Private Credit* (Algeria, Argentina, India, Mexico, Paraguay, Philippines, Venezuela). In El Salvador, Thailand, and United States, we find evidence for bi-directional causality. When we use the *M2* as the measure of financial development, we find evidence for causality between financial development and international trade in the countries examined, with exception of Japan. As mentioned above, our preferred measures of financial development and international trade are the *Private Credit* and *Manufacturing Trade*, respectively. Of the 11 countries, 5 countries (Argentina, El Salvador, Honduras, Mexico, and United States) exhibit one-way causality running from *M2* to *Total Trade* whilst there are only 2 countries (Algeria and Israel) where the direction of causality runs from *Total Trade* to *M2*. However, Australia, Malaysia, and Venezuela exhibit strong bi-directional causality between *M2* and *Total Trade*.

In sum, the results in Tables 2, 3, 4 show that financial development is strongly associated to international trade. The direction of the causality varies across countries. The Granger causality from financial development to international and the Granger causality from international trade to financial development coexist. Furthermore, these results show that there is a bi-directional relationship between the level of financial development and international trade.

These results reconcile the two opposing views in the empirical literature on the finance-trade nexus. On the one hand, there is empirical support that countries with better-financial sectors will tend to specialize in industries that rely on external finance (See, for instance, Beck, 2002, 2003; Becker & Greenberg, 2007; Manova, 2005; Svaleryd & Vlachos, 2005). On the other hand, a number of studies find evidence for the reverse link : international trade lead to financial sector development, mainly due to an increasing demand for financial services by foreign-oriented sector (see for instance Do & Levchenko, 2007; Huang & Temple, 2005; Baltagi *et al.*, 2009). Whereas these studies find evidence only for one-way causality running either from finance to trade or from trade to finance, we show that a bi-directional relationship between the level of financial development and international trade may also exist. Furthermore, it is apparent that the causality patterns vary across countries. On average, financial development contributes more to the causal relationship in the developing countries than in the developed countries. However, some caution must be exercised in interpreting economically the Granger-causality tests, particularly when the causality appears to be the result of some intrinsic property of the system rather than a prediction. In order to ensure that our baseline results are not due

to an artifact, we conduct some robustness checks in panel data framework.

5. Robustness : Initial financial development, trade and the issue of causality

The design of our robustness tests is based on the tradition of cross-country empirical studies on the association between financial development and the real economy (See for instance WorldBank, 1989; Barro, 1991; Roubini & Sala-i Martin, 1992; King & Levine, 1993; Levine, 1997). We implement these robustness tests by studying the association between the level of financial development and future levels of international trade and then we look at the association between international trade and *future* levels of financial development. Therefore, we estimate the following regressions :

$$Trade_{it} = \alpha^1 + \beta_1^1 Finance_{it} + \beta_2^1 X_{it} + \mu_i + \gamma_t + \epsilon_{it} \tag{7}$$

$$Finance_{it} = \alpha^2 + \beta_1^2 Trade_{it} + \beta_2^2 X_{it} + \mu_i + \gamma_t + \epsilon_{it} \tag{8}$$

where $Trade_{it}$ is one of the two indicators of international trade and $Finance_{it}$ is one of the two indicators of financial development for the country i in period t. X represents a set of conditioning to control for other factors associated with international trade in Equation 7 and financial development in Equation 8. α, β_1, and β_2 are unknown parameters to be estimated. μ, γ, and ϵ are respectively country fixed effects, time fixed effects, and idiosyncratic error term. Country fixed effects control for any fixed effects common across countries while time dummies allow us to account for business cycle effects. In line with the empirical literature on the relationship between finance and trade, we control for the Initial real GDP per capita, the Total population, inflation, and the ratio of net inflows of Foreign direct investment (FDI) to GDP as a proxy of financial openness. We also control for the Growth rate of terms of trade. In these equations, β_1^1 and β_1^1 are our coefficients of interest.

5.1. Initial financial development and the issue of causality

In this sub-section, we examine the relationship between the initial values of the financial development at the beginning of considered periods and subsequent international trade using ordinary least squares (OLS) regressions. Equation 7 is estimated on our

TABLE 6 – Initial *Private Credit* and international trade, 5 and 10 years averages, 1961-2010 : OLS

Dependent variable	5-year averages				10-year averages			
	Manufacturing Trade (a)		*Total Trade (a)*		*Manufacturing Trade(a)*		*Total Trade (a)*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Initial *Private Credit* (a)	0.099***		0.074*		0.102***		0.053	
	(0.026)		(0.042)		(0.031)		(0.066)	
Initial *M2* (a)		0.146***		0.122*		0.119**		0.017
		(0.050)		(0.070)		(0.048)		(0.088)
Initial real GDP per capita (a)	-0.000**	-8.40e-06*	-0.000***	-0.000*	-9.92e-06*	-6.62e-06	-0.000*	-0.000*
	(4.92e-06)	(4.93e-06)	(0.000)	(0.000)	(5.69e-06)	(5.81e-06)	(0.000)	(0.000)
Total population (a)	0.124	0.063	-0.287	-0.332	0.175	0.103	-0.082	-0.121
	(0.161)	(0.162)	(0.287)	(0.285)	(0.179)	(0.187)	(0.381)	(0.377)
Inflation (b)	-0.015	-0.009	0.053*	0.058**	-0.021*	-0.016	0.029	0.026
	(0.013)	(0.013)	(0.027)	(0.027)	(0.011)	(0.011)	(0.027)	(0.025)
FDI (a)	0.033**	0.022*	0.076***	0.069***	0.020***	0.014*	0.055***	0.051***
	(0.014)	(0.013)	(0.023)	(0.023)	(0.007)	(0.007)	(0.013)	(0.013)
Growth rate of terms of trade	0.371***	0.494***	-0.979***	-0.876***	0.325***	0.382***	-1.235***	-1.282***
	(0.090)	(0.094)	(0.197)	(0.207)	(0.098)	(0.113)	(0.252)	(0.262)
Constant	2.380	3.169	7.758*	9.139*	1.632	2.839	5.216	6.224
	(2.441)	(3.127)	(4.276)	(5.349)	(3.190)	(3.321)	(7.424)	(7.340)
Time fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Country fixed effects	YES	YES	YES	YES	YES	YES	YES	YES
Observations	173	173	173	173	95	95	95	95
Number of countries	21	21	21	21	21	21	21	21
R-squared	0.826	0.821	0.906	0.906	0.866	0.860	0.932	0.931

Note : ***, ** and * represent statistical significance at 1%, 5%, and 10% respectively. Robust standard errors are reported in parentheses. X (a) and X(b) indicate that X is included as log(X) and log(1+X), respectively.

sample of 21 countries and on a sample of nonoverlapping five-year averages of all the variables from 1961-1965 to 2006-2010. Furthermore, this regression is also run on a sample of nonoverlapping ten-year averages of all the variables from 1961-1970 to 2001-2010. The regression results are presented in Table 6. Estimates using five-year averages and ten-year averages are reported in Columns 1-4 and Columns 5-8, respectively. Interestingly, these results indicate that all the coefficients on financial development are statistically significant, with exception of *Total Trade* regressions (Columns 7 and 8). This also implies an economically important relationship between financial development and international trade. For example, the coefficient of 0.099 on initial *Private Credit* in Column 1 implies that a country that increased initial *Private Credit* from the mean of the slowest growing quartile of countries to the mean of the fastest growing quartile of countries would have increased its subsequent ratio of manufacturing trade to GDP by about 0.113 percent. This represents about 0.434 of a standard deviation of the ratio of manufacturing trade to GDP. A 10 percent exogenous increase in the initial *M2* is associated with an increase of about 1.5 percentage points in the subsequent ratio of manufacturing exports (column 2). Very, similar results are found when using *Total Trade* as the measure of trade flows.

These results support the idea that the level of financial development is a good predictor of subsequent international trade. This is particularly the case *Private Credit* is the indicator of financial development and when *Manufacturing Trade* is the dependent variable. Furthermore, our measures of international trade are associated with the initial real GDP per capita, inflation, and the growth rate of terms of trade over the next five and ten years.

5.2. Initial trade and the issue of causality

As in the previous subsection, the second robustness test is to analyze the relationship between the initial values of international trade at the beginning of considered periods and subsequent levels of financial development using OLS regressions. As previously, Equation 8 is estimated a sample of nonoverlapping five-years averages of all the variables from 1961-1965 to 2006-2010, as well as on ten-year averages of all the variables from from 1961-1970 to 2001-2010. Table 7 summarizes these results. The estimates using five-year averages and ten-year averages are reported in Columns 1-4 and Columns 5-9, respectively. The set of control variables is identical to those in the previous subsection.

These results indicate that countries with higher levels of trade openness experience

TABLE 7 – Initial *Private Credit* and international trade, 5 and 10 years averages, 1961-2010 : OLS

Dependent variable	5-year averages				10-year averages			
	Private Credit (a)		*M2 (a)*		*Private Credit(a)*		*M2 (a)*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Initial *Manufacturing Trade* (a)	1.017***		0.467***		1.115***		0.488***	
	(0.274)		(0.129)		(0.355)		(0.153)	
Initial *Total Trade* (a)		0.376**		0.155		0.484*		0.131
		(0.179)		(0.099)		(0.260)		(0.139)
Initial real GDP per capita (a)	0.000*	0.000**	1.01e-06	2.02e-06	0.000	0.000	-5.65e-06	-2.80e-06
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Total population (a)	-0.990*	-0.881	0.005	0.052	-1.141*	-0.939	-0.008	0.082
	(0.540)	(0.564)	(0.286)	(0.297)	(0.630)	(0.660)	(0.325)	(0.330)
Inflation (b)	-0.024	-0.078	-0.089***	-0.113***	-0.058	-0.098**	-0.116**	-0.131***
	(0.043)	(0.054)	(0.032)	(0.032)	(0.038)	(0.044)	(0.044)	(0.046)
FDI (a)	-0.134*	-0.151***	-0.038*	-0.044*	-0.067***	-0.076***	-0.012	-0.014
	(0.046)	(0.048)	(0.022)	(0.023)	(0.023)	(0.023)	(0.014)	(0.015)
Growth rate of terms of trade	-0.159	0.633	-1.009***	-0.664***	-0.421	0.464	-0.909***	-0.635*
	(0.438)	(0.545)	(0.186)	(0.229)	(0.478)	(0.702)	(0.246)	(0.350)
Constant	13.266	14.814*	1.448	2.256	18.278*	19.992	1.604	3.315
	(8.037)	(8.402)	(4.273)	(4.434)	(10.809)	(12.678)	(5.526)	(6.359)
Time fixed-effects	YES	YES	YES	YES	YES	YES	YES	YES
Country fixed-effects	YES	YES	YES	YES	YES	YES	YES	YES
Observations	173	173	173	173	95	95	95	95
Number of countries	21	21	21	21	21	21	21	21
R-squared	0.786	0.764	0.889	0.881	0.798	0.777	0.894	0.887

Note : ***, ** and * represent statistical significance at 1%, 5%, and 10% respectively. Robust standard errors are reported in parentheses. X (a) and X(b) indicate that X is included as log(X) and log(1+X), respectively.

higher levels of financial development. Initial *Manufacturing Trade* and Initial *Total Trade* enter significantly positive in our regressions, with exception of regressions 4 and 8 when using *M2* as the measure of financial development and when *Total Trade* is the dependent variable. This is consistent with the results of Granger-causality tests and could be explained by the fact that sectors of goods with increasing returns to scale (manufactured goods) enjoy from a higher level of external finance more than sectors of other goods, due to gains from economies of scale. The effect of international trade on financial development is economically significant. For example, the coefficient of 1.017 on the Initial *Manufacturing Trade* in Column 1 implies that moving from the 25th to the 75th percentile of the initial level of *Manufacturing Trade* results in an increase in *Private Credit* of 0.451 percent points, or about 0.556 of a standard deviation of *Private Credit*. As for the Initial *Total Trade*, the coefficient of 0.376 in Column 2 implies that moving from the 25th to the 75th percentile of the initial level of *Total Trade* leads to an increase in *Private Credit* of 0.302 percent points, or about 0.373 of a standard deviation of *Private Credit*. Consequently, the data support the hypothesis that the level of trade openness is a good predictor of subsequent level of financial sector development. Furthermore, our measures of international trade are associated with the initial real GDP per capita, inflation, and the growth rate of terms of trade over the next five and ten years.

In sum, results in Table 6 and 7 confirm the results from our Granger-causality tests. Financial development is strongly associated with trade openness. We find that, not only, the level of financial development is a good predictor of subsequent international trade, but also countries with higher levels of trade openness experience higher levels of financial development.

6. Concluding remarks

In this paper, we explored the empirical association between the level of financial sector development and the trade openness using improved time series techniques. After establishing the order of integration of each variable and testing for cointegration, we carried out ECM-based causality tests and Causality tests based on first difference VARs. Our results indicate that financial development is strongly and robustly linked to international trade, with a direction of causality varying across countries. The Granger causality from finance to trade and that from trade to finance coexist. On average, Financial deepening seems

to contribute more to the causal relationships in the developing countries than in the developed countries. These benchmark results on the link between financial development and international trade are robust to a number of robustness checks based on estimates on a sample of nonoverlapping five-year and ten-year averages.

Our results have policy implications for both financial and foreign-oriented sectors. Financial sector policies that raise the access to financial services and reduce credit constraints may lead to increased comparative advantage in industries that use more outside finance, especially in manufactured goods. Such financial policies should disproportionately help foreign-oriented firms (or industries) for their growth. Alternatively, policy reforms that promote the foreign-oriented sector may lead to a increased demand for financial services and to financial sector development.

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A. Appendix

TABLE 8 – Unit root test for *Private Credit*, *M2*, *M2*, *Manufacturing Trade*, and *Total Trade*

Country	H0 : Unit root in variable							
	PC		M2		MT		TT	
	ADF	k	ADF	k	ADF	k	ADF	k
Algeria	-1.109	0	-1.751	3	-1.161	1	-1.948	1
Argentina	-2.568	0	-1.725	2	-1.096	1	-0.727	0
Australia	0.599	1	1.665	1	-1.830	1	-0.382	4
Canada	-1.750	6	0.885	6	-2.912*	1	-1.538	1
Denmark	-0.048	0	1.172	2	-2.195	0	-0.689	0
Egypt	-1.228	0	-1.593	6	-2.985**	1	-2.365	1
El Salvador	-1.924	0	-1.456	3	-3.915***	4	-1.889	0
Guatemala	-1.107	0	-0.456	1	-2.794*	0	-2.494	3
Honduras	-2.693*	0	-0.444	2	-3.735***	0	-2.416	7
India	-0.771	10	-0.270	4	-2.458	1	0.446	0
Israel	-2.233	4	-1.993	1	-1.655	0	-3.092**	0
Japan	-1.718	1	-2.640*	2	-0.950	0	-2.592	1
Korea. Rep.	-1.316	0	-2.548	1	-7.989***	0	-2.187	0
Malaysia	-2.276	2	-2.290	4	-1.598	3	-0.851	0
Mexico	-3.185**	5	-2.911*	1	-0.924	0	-0.294	0
New Zealand	-0.661	0	-1.334	1	-1.296	0	-2.204	8
Paraguay	-2.066	0	-0.771	0	-2.390	0	-2.066	0
Philippines	-2.450	2	-0.252	1	-0.567	1	-1.263	0
Thailand	-1.918	1	-1.486	2	-0.693	2	-0.317	0
United States	-1.714	8	-1.007	1	-2.332	1	-1.680	0
Venezuela	-3.199**	9	-3.588**	9	-1.872	3	-2.893*	0

Note : PC, M2, MT, and TT denote *Private Credit*, *M2*, *Manufacturing Trade*, and *Total Trade*, respectively.

TABLE 9 – Unit root test for D.*Private Credit*, D.*M2*, D.*M2*, D.*Manufacturing Trade*, and D.*Total Trade*

Country	H0 : Unit root in variable							
	D.PC		D.M2		D.MT		D.TT	
	ADF	k	ADF	k	ADF	k	ADF	k
Algeria	-4.900***	0	-3.972***	1	-9.997***	0	-4.968***	1
Argentina	-7.085***	0	-5.420***	1	-6.528***	0	-8.492***	0
Australia	-5.104***	0	-3.076**	0	-10.265***	0	-5.219***	3
Canada	-3.235**	5	-4.207***	5	-	-	-4.363***	0
Denmark	-6.339***	0	-4.383***	1	-5.820***	0	-5.109***	1
Egypt	-6.742***	0	-4.158***	5	-	-	-5.692***	0
El Salvador	-7.068***	0	-3.079**	2	-	-	-6.674***	0
Guatemala	-7.055***	0	-5.095***	0	-	-	-3.747***	4
Honduras	-	-	-5.309***	1	-	-	-2.772*	8
India	-2.990**	10	-2.871*	10	-10.739***	0	-5.962***	0
Israel	-7.462***	3	-5.160***	1	-6.556***	0	-	-
Japan	-5.214***	0	-	-	-5.166***	0	-4.996***	0
Korea. Rep.	-4.020***	0	-3.819***	0	-	-	-5.637***	0
Malaysia	-10.315***	1	-3.553**	3	-6.486***	2	-4.969***	0
Mexico	-	-	-	-	-6.299***	0	-5.653***	0
New Zealand	-5.797***	0	-3.449**	0	-5.798***	0	-3.268**	8
Paraguay	-5.303***	0	-6.255***	0	-8.759***	0	-5.303***	0
Philippines	-4.555***	0	-4.990***	0	-9.350***	0	-6.418***	0
Thailand	-3.850***	0	-4.689***	1	-7.431***	1	-7.366***	0
United States	-2.938*	7	-3.321**	0	-4.032***	0	-5.132***	0
Venezuela	-	-	-	-	-9.803***	1	-	-

Note : PC, M2, MT, and TT denote *Private Credit*, *M2*, *Manufacturing Trade*, and *Total Trade*, respectively.

TABLE 10 – Engle-Granger cointegration tests

Country	Variables in cointegration vector							
	PC, MT		PC, TT		M2, MT		M2, TT	
	ADF	k	ADF	k	ADF	k	ADF	k
Algeria	-1.208	4	-1.396	5	-1.300	4	-1.590	5
Argentina	-1.543	3	-0.602	2	-2.204	5	-1.171	3
Australia	-2.069	5	-3.356**	5	-1.070	4	-2.135	1
Canada	-	-	-2.984**	5	-	-	-3.228**	1
Denmark	-2.627*	1	-1.904	4	-3.424**	4	-3.266**	1
Egypt	-	-	-3.352**	5	-	-	-3.280**	5
El Salvador	-	-	-2.422	1	-	-	-2.237	4
Guatemala	-	-	-3.451**	3	-	-	-2.724*	4
Honduras	-	-	-		-	-	-2.215	5
India	-2.768*	1	-2.428	4	-2.939**	2	-2.646*	4
Israel	-2.446	5	-	-	-2.917*	1	-	-
Japan	-1.908	5	-2.630*	1	-	-	-	-
Korea. Rep.	-	-	-2.707*	1	-	-	-2.725*	1
Malaysia	-2.447	4	-2.310*	1	-2.151	1	-1.840	4
New Zealand	-1.375	5	-3.582**	2	-1.545	3	-3.544**	2
Paraguay	-2.762*	1	-1.782	1	-2.812*	1	-2.723*	1
Philippines	-1.809	3	-1.812	2	-3.551**	3	-2.915*	1
Thailand	-2.424	1	-1.689	2	-2.801*	1	-2.858*	2
United States	-1.701	3	-2.074	4	-1.928	3	-2.030	3

Note : PC, M2, MT, and TT denote *Private Credit*, *M2*, *Manufacturing Trade*, and *Total Trade*, respectively. ADF= Augmented Dickey-Fuller test. k= number of lags in the second step regression. The number of lags is determined automatically based on Akaike Information Criterion (AIC). n=number of observations in the first step regression. *, **, and *** indicate statistical significance at 10%, 5%, and 1% levels, respectively based on critical values from MacKinnon (1990, 2010).